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ON-LINE MEASUREMENTS OF VERY LOW CONCENTRATIONS OF EC/OC AEROSOLS AT A FINNISH SUB-ARCTIC BACKGROUND STATION

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INTRODUCTION

Carbonaceous aerosols are routinely monitored in their basic forms - organic carbon (OC) and elemental carbon (EC) - at many atmospheric stations. In such cases, accuracy of measurement is important both in terms of using these data for long-term studies and their use in various models.

In this work, we tested the possibilities of an on-line Sunset Lab. EC/OC analyser during measurements when aerosol concentrations were close to detection limits declared by the manufacturer.

EXPERIMENTAL SETUP

Two-month (Oct-Nov 2015) measurements were performed at the background subarctic station Sammaltunturi (67°58′24″N, 24°06′58″E), which is the part of Pallas-Sodankylä GAW station located in Lapland, the northernmost region of Finland.

For the study, data measured in 8 h time resolution on two simultaneously running on-line EC/OC analysers at total and interstitial inlets were used. Collected samples were analysed by shortened EUSAAR2 protocol and OC fractions (evolved based on different volatility/ evaporated from the sample at individual temperature steps) were also studied. In parallel to EC/OC measurements, equivalent black carbon (eBC) was measured using an aethalometer and MAAP (Fig. 1).

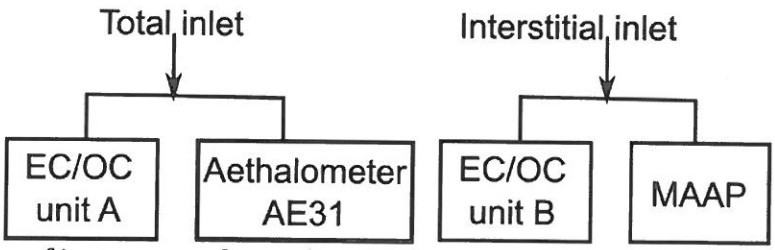

Fig. 1: Scheme of instrumental sampling.

RESULTS AND CONCLUSIONS

Analysis of OC data showed that even though the OC concentrations were always above the analyser detection limit, up to 70% of given concentration was a contribution of the dynamic blank (gaseous phase). The concentrations of the most volatile fraction OC1 (<200°C) were usually in the range of values of an average dynamic blank. The

major part of OC aerosol phase was present in the least volatile fractions OC3 (evolving at 300-450°C) and OC4 (450-650°C).

Thermal EC concentrations were below declared detection limit during main part of the measurement period. Firstly, data were evaluated by program RTCalc (provided by Sunset Lab.) in version 526, however, the results were biased by wrong determination of automatic OC-EC split point, which usually led to an overestimation of real EC concentrations. Secondly, raw data were evaluated by newly released RTCalc703 with new option for laser-temperature correction. Results from RTCalc703 provided improved values of thermal EC even during very low aerosol concentrations. It was supported by comparison with equivalent black carbon (eBC) concentrations measured in parallel by aethalometer (Fig. 2).

Last but not least, a comparison of eBC data was carried out on laser measurement of on-line Sunset Lab. analyser (Zikova et al., 2016) together with results from other optical instruments (aethalometer and MAAP). It shows that eBC resulting from Sunset Lab. instrument also provide a reasonable alternative to EC values measured during low aerosol concentrations.

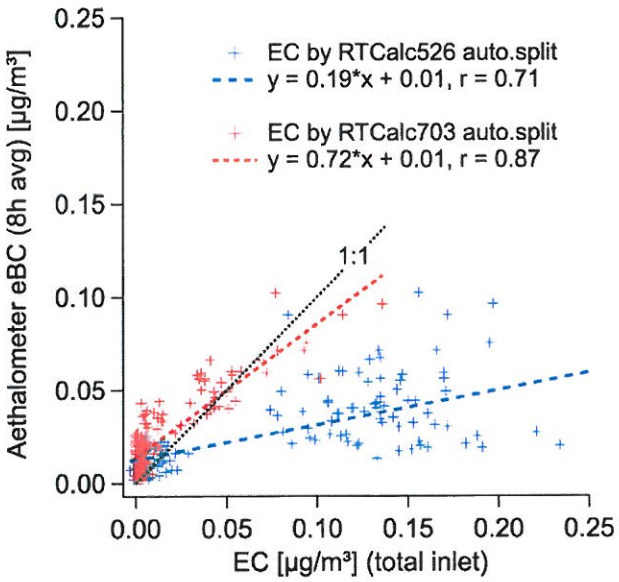

Fig. 1: Comparison of eBC from aethalometer with results of EC (from total inlet) calculated by RTCalc software versions 526 (blue) and 703 (red).

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